



Sedimentology of the Lower Cretaceous Sparky Formation, Marsden South Sparky Pool, Lloydminster Area

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Abstract

An integrated geological and geophysical analysis of has been carried out on the marginal-marine deposits of the Sparky Formation in the Lloydminster area of Saskatchewan. These deposits form the primary reservoir in the Marsden South Sparky Pool and comprise multiple stacked, low-energy progradational shoreline sand units and compound incised valley fill (IVF) deposits. Reservoir facies are capped by late Sparky and Waseca-aged non-marine (crevasse splay, channel fill, coal swamp) deposits that form a vertical seal. Locally, these younger channels, partially erode reservoir sand units and, effectively, compartmentalize the pool. However, they also create a stratigraphic trap along the northern and eastern edge of Marsden .

Progradational shoreline sands are regionally deposited over Marsden but are best preserved in the SE portion where they form the primary reservoir. Three upward-cleaning parasequences (<1-8m thick) bounded by 1-2m thick flooding surfaces were deposited. Flooding surfaces form vertical flow barriers and prevent hydraulic communication between successive progradational sequences. Sand quality, as indicated by net:gross and permeability, improves stratigraphically upwards. Porosity range is 21-33% and permeability varies between 200-800mD. IVF deposits comprise 2 distinct reservoir facies: (1) shelly-sand, deposited in a back-barrier and/or tidal inlet; and, (2) sandy inclined heterolithic stratification (IHS), deposited by tidally-influenced meandering channels. Shelly-sand deposits occur only locally in the west and northwest portion of the pool. These deposits are characterized by blocky sand with articulated and fragmented calcite-cemented bivalve and gastropod shells interstratified with thin (mm to cm-scale) silt layers. Porosity and permeability in this facies is highly variable, ranging from 12-34% and 50-1900mD, respectively. IHS deposits are the dominant and best quality reservoir facies in Marsden. The IHS sands are blocky, fine- to medium-grained, well-sorted, dune cross stratified and contain rare mm- to cm-thick mud beds. Porosity averages between 30-35% and permeability averages around 3500-3700mD.